

EL9343 Homework 4

(Due Oct 5th, 2021)

No late assignments accepted

All problem/exercise numbers are for the third edition of CLRS text book

1. For the following array:

$A = \langle 15, 22, 25, 17, 12, 19, 23, 16, 24, 14, 10, 26 \rangle$

- (a) Create a max heap using the algorithm BUILD-MAX-HEAP.
- (b) Design an algorithm to create a min heap. (Pseudocode is required)
- (c) Create a min heap using the algorithm you designed in 1(b)
- (d) Remove the largest item from the max heap you created in 1(a), using the HEAP-EXTRACT-MAX function. Show the array after you have removed the largest item.
- (e) Using the algorithm MAX-HEAP-INSERT, insert 11 into the heap that resulted from question 1(d). Show the array after insertion.

2. Design two different algorithms to merge k sorted arrays, and return it as a new array. The new array should be made by splicing together the nodes of the k arrays. Additionally, the total number of elements of all arrays is kn . (Notice that the number of elements of each array is not necessarily the same). One of your algorithms should run in $O(kn \log k)$ time. Please give the procedure of your algorithm and analyze the running time. (Description is enough, you do not need to provide any pseudocode)

For example:

Input: A: $\langle 1, 4, 7, 10 \rangle$, B: $\langle 2, 5, 8, 11 \rangle$, C: $\langle 3, 6, 9 \rangle$

Output: $\langle 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 \rangle$

3. For the following array:

$A = \langle 1, 5, 9, 6, 3, 2, 8, 7, 4, 0 \rangle$

- (a) Illustrate the operation of quick sort on array A
- (b) Illustrate the operation of merge sort on array A
- (c) Explain the advantage and disadvantage of sorting an array by quick sort compared to using merge sort.

4. For an disordered array with n elements, design an algorithm for finding the median of this array. Your algorithm should traverse the array only once.

ps:

You can imagine the array as a flow which means you can get the data one by one.

The size of this array --n is big and you know the size of the array from the start.

Please do not sort the array, or you can not get full mark.

A hint to solve this problem is using heap.